Annual Report

FOREST PEST CONDITIONS IN WISCONSIN

1953

WISCONSIN CONSERVATION DEPARTMENT

COOPERATIVE FORESTRY DIVISION

FOREST PESTS — SURVEY AND CONTROL

ANNUAL REPORT

FOREST PEST CONDITIONS IN WISCONSIN

1953

By
Wisconsin Conservation Department
Cooperative Forestry Division

In Cooperation With
Wisconsin Department of Agriculture, State Entomologist
University of Wisconsin
Private Industry
Counties

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INTRODUCTION

It is felt the forest pest control program should be reviewed at least once every five years. Since the program was formally established in 1949, a review is now in order and the following recapitulation is combined with the report of forest insect conditions for 1953. The review is made for several reasons; it will endeavor to show in a few words:

1. Purpose of the program.
2. The reason and authority for the undertaking by the Conservation Department.
3. Area of responsibility.
4. General concepts of control.
5. The attitude of the professional foresters and the public.
6. Accomplishments to date.
7. Anticipated improvement.

PURPOSE. The program as established is intended to control forest pests on or threatening forests of Wisconsin in order to protect and preserve forest resources, enhance the growth and maintenance of forests, promote stability of forest-using industries, aid in fire control by reducing the menace created by dying and dead trees, conserve forest cover on watersheds and protect wildlife habitat and other values inherent in the forest.

Insects and diseases that attack forest trees cause greater loss of merchantable timber each year in the United States than any other cause. One of the primary reasons for this great loss is the lack of a fully activated forest pest control program in all forested states.

AUTHORITY. In enumerating and evaluating the intended purpose and facilities of the different State agencies, it is clear that the Conservation Commission has certain responsibilities. Legislation relating thereto is listed below:

Wisconsin Constitution - Article VIII, Section 10

.....the state may appropriate moneys for the purpose of acquiring, preserving and developing the forests of the state.

23.09 Conservation Act

(1) Purpose. The purpose of this section is to provide an adequate and flexible system for the protection, development and use of forests, fish and game, lakes, streams, plant life, flowers and other outdoor resources in the state of Wisconsin.

28.01 The Conservation Commission shall execute all matters pertaining to forestry within the jurisdiction of the state, direct the management of state forests, collect data relative to forest uses and conditions and advance the cause of forestry within the state.

23.09 Conservation Act

(7) The commission is ..... authorized to ..... establish such service as deemed necessary to carry out the provisions of this act.

(h) To enter into cooperative agreements for purposes consistent with this act.

(8) ..... Authorized to cooperate with state departments and officials in conduct of matters in which interests overlap.

23.11 (1) In addition ..... commission is empowered and required to have and take the general care, protection and supervision ..... of all state forests, parks, etc..... and all other state-owned lands not under care and supervision of some other state officer, body or board.

28.07 The commission may cooperate with the College of Agriculture of the University of Wisconsin and with departments of this and other states, with federal agencies or with counties, towns, corporations or individuals to the best interest of the people and the state in forest surveys, research in forestry and related subjects, forest protection and in assistance to landowners to secure adoption of better forestry practice.

29.29 (4) Conservation Commission, State Board of Health and Department of Agriculture shall jointly regulate use of toxic insecticides in forest areas.

It would appear that the intent of the law is that the Conservation Commission shall have full authority to do all things necessary (including insect and disease control) on all state forests, parks and other lands under its jurisdiction including the authority to establish such services as are deemed necessary to carry out the broad provisions of the conservation act which includes the protection of the forests of the state.

Further, the Commission is to advance the cause of forestry within the state and may cooperate with other states, federal government, governmental sub-divisions, corporations or individuals and with other state departments and officials in conduct of matters in which interests overlap.

Present legislation is limited to that outlined above plus that found in Chapter 94 of the statutes which deals with the promotion of agriculture. It is felt that these laws may be inadequate and that legislation should be enacted that relates specifically to forestry wherein forest pests are declared to be a public nuisance. Such legislation would declare the responsible agency, purpose and policy; define person, control, infestation, forest pest, forest land and timber;

indicate powers of the responsible state agency and duties in respect to conducting of surveys and investigations, establishment of control zones, publication of notices, distribution of costs of controls, etc. Legislation of this kind is under consideration at the present time.

AREA OF RESPONSIBILITY. Referring to the purpose of the program, "the control of forest pests on or threatening forests of Wisconsin," it can be seen that a relatively narrow area is being covered in the field of economic entomology. The department is interested only in forest pests. Not all insects found in the forest can be called forest pests. For practical purposes, a pest must be defined as any insect or disease which is determined to be harmful, injurious or destructive to forests or timber. It must also be recognized that a forest insect can be a pest under some conditions and not under others. Inquiries relating to insect pests other than forest pests such as those affecting shade trees, ornamentals, fruit trees, ornamental windbreaks, shrubs, etc. are referred to the Office of the State Entomologist, State Department of Agriculture, 315 North Carroll Street, Madison 3, Wisconsin.

Although forest insects or the protection of forest crops is not specifically mentioned in Chapter 94 of the Wisconsin Statutes as is the protection of agricultural crops, the terminology is broad enough to cover forestry. That is to say the powers and duties of the Department of Agriculture with respect to insect pests and plant diseases are not restricted to agricultural lands or crops.

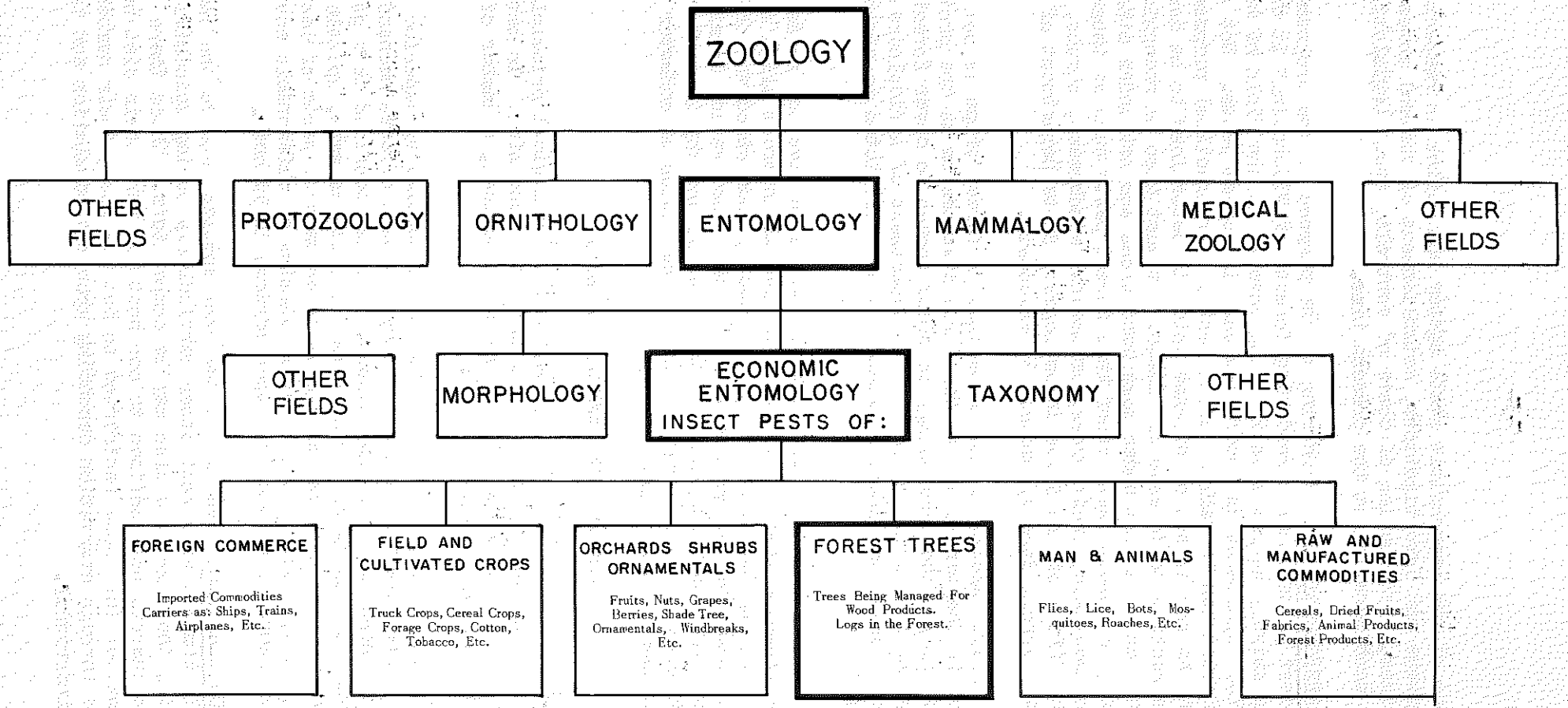
On the following page is a diagrammatic sketch to give the reader a better concept of the channels into which fields of special interest align most naturally. After studying the chart, it can be readily understood why this phase of the program should be the responsibility of the Conservation Commission, which is charged with the management of the forests, and why it would be impractical to divorce by administrative lines those fields of endeavor that are inseparable because of their very nature.

CONTROL: ITS GENERAL CONCEPTS

Before instituting a control program, several biological principles must be understood and followed if the program is to be successful. To better understand why some of the "controls" are or are not practical, a number of facts about insects in general are given below:

COVER. Insects living in the open can avoid enemies by superior ability in locomotion, protective coloration, mimicry, certain offense mechanisms, or a combination of these or other adaptations. Species confined to a particular habitat must seek various types of cover and retreats as webs, spittle masses, loose bark, etc. or resort to camouflage as cases made of parts of leaves, soil, debris, stones, silk, sticks, etc. to avoid enemies or unfavorable environmental conditions as extremes of weather or other adverse influences.

COMPETITION FOR FOOD. Members of the same species require the same food and consequently compete with each other particularly during epidemics; other species requiring the same food also may be competitors. Where there is a food shortage, those insects not confined to one host may vary their diet but survival is a critical matter for those restricted to but one host; their numbers may be greatly reduced through starvation depending upon the population and the amount eaten by each individual.



ECONOMIC ENTOMOLOGY IS CONCERNED WITH INSECTS IN RELATION TO CROPS, COMMODITIES, AND MAN; SPECIFICALLY THE LIFE HISTORIES OF INSECTS AND THEIR ECOLOGY: THEIR ERADICATION OR CONTROL THROUGH THE USE OF INSECTICIDES, HEAT, COLD, LIGHT AND NATURAL ENEMIES, WEATHER, PARASITES AND PREDATORS, AS OTHER INSECTS OR BIRDS. IT IS ALSO CONCERNED WITH THE PLANNING AND ENFORCEMENT OF REGULATORY MEASURES TO PREVENT THE SPREAD OF INSECT PESTS, WITH THE EDUCATION OF FARMERS AND OTHERS IN THE PREVENTION OR CONTROL OF INFESTATIONS, AND IN IDENTIFICATION OF PESTS.

ENEMIES. Every insect that consumes another is called an enemy and its victim its prey. Any food chain after the first plant-eating insect is a succession of predations. Predators differ from parasites in that they destroy their prey outright; parasites obtain food and shelter from the host at the latter's expense. The host can live without the parasite but the parasite cannot exist without the host.

PREDATOR-PREY RELATIONSHIP. It is generally accepted that predators play a definite part in regulating the numbers of their prey. However, the relationship is so variable as to make the two appear interdependent and a balance is continually being sought in nature; it is important that we recognize this fact. If a prey population increases, it will support more predators; if the predators then also increase, there will be a heavier toll of the prey whereupon they will be reduced. In either case the numbers of the predator tend to lag behind those of the prey. A point of decrease in the population of the prey is reached beyond which it becomes unprofitable for the predator to pursue that particular kind of prey; the predator must then find another food source or suffer decline. The role of a predator (in considering an insect population of a particular species) must be interpreted in conjunction with the other insect populations present since predators are usually non-specific.

PARASITE-HOST RELATIONSHIP. This relationship is extremely complex. The larvae of some insects are parasitic on other insects; such parasites are the tachinid flies (Diptera) and the ichneumonid, braconid, and chalcid wasps (Hymenoptera). Other insects, the scelionids (Hymenoptera) are egg parasites. Many of the beneficial parasites are preyed upon by other parasites, called hyperparasites. Hyperparasitism may be carried to the second or third degree. The tussock moth caterpillar (Hemerocampa leucostigma) was found to have 23 primary parasites, which in turn had 13 secondary or hyperparasites; the hyperparasites in turn were subject to 5 tertiary parasites. An added complexity is synchronism and range. The life cycle of the parasite must be synchronized with that of the host so that it may complete its development; it must also be able to live within the same range as the host. Although in many cases the attempted introduction of a natural enemy of foreign pests to serve as a check has met with little or no success, those that have been successful have been markedly so.

PARASITIC FUNGI. Since moisture and temperature conditions are so exacting for the growth and spread of parasitic fungi, control by such fungi has been seldom achieved as a result of direct introduction.

VIRUS DISEASES. Virus diseases sometimes take a heavy toll of insects and appear to be selective as to species. Studies by entomologists are demonstrating that outstanding results may be achieved through the use of these pathogens in the field of forest entomology.

BIRDS AND MAMMALS. Birds often play an important part in the control of harmful pests where such pests are abundant, but not at epidemic levels. On the other hand, birds are non-selective in their choice of insects and may eat many beneficial insects. Several species of rodents are important in the destruction of forest insects hibernating in the soil, duff, or leaf litter.

INFLUENCE OF THE WEATHER. Climatic factors as temperature, moisture, prevailing winds, and unusual weather conditions have an important bearing on the activity, cyclic abundance, and distribution of insects. Their activities may be limited by temperatures above or below the optimum. Low winter temperatures in exposed areas and fluctuating temperatures may take a heavy toll of insects.

Moisture plays an important role through its effect on both the host and the insects. Moisture may increase the vigor of the trees and lessen the damage of attack. Some insects may thrive best in dry weather while others prefer moist conditions. Unusually heavy rainfall or hail may knock many insects from the trees and cause their deaths. On the other hand, storms may injure trees to the extent that a buildup in bark beetles will occur and healthy trees may eventually be attacked.

SUMMARY OF INFLUENTIAL FACTORS. The abundance and occurrence of insects may be affected by abundance, condition, and site of host plants or food, by predators and parasites, by weather conditions as temperature, moisture, and drought, by cover, and by parasitic fungi and diseases. The influence may be beneficial or detrimental.

TYPES OF CONTROL: (Some major phases)

SILVICULTURAL CONTROL. "The newest indirect control of insects is the so-called silvicultural method. This is a marked step beyond the sanitation and salvage practices of European and early American forestry".

"In Canada the effectiveness of silvicultural control is being given more and more weight. On the 253,000 acre Green River Project, an intensive study has been undertaken to test the theory that vulnerability of a forest to budworm attack increases with the density of the balsam-spruce stand, its age, and the percentage of balsam. However, on probably 99 percent of Canada's forest, where no silviculture is being practiced, other methods of control obviously will be required if any protection is to be given." 1/ (In the budworm project 200,000 acres were sprayed in 1952 and over 1,000,000 acres in 1953; about 1,250,000 acres will be sprayed in Quebec and New Brunswick in 1954.)

In second growth stands extensive damage does not often occur because of the good vigor of the trees which tend to resist attack. However, stand composition and density largely determine whether an epidemic may or may not arise. This has been demonstrated in the outbreaks of the spruce budworm, gypsy moth, white pine weevil, and others. Transition types should be utilized before the trees earlier in the succession are lost and management should favor the climax type of the area. Management practices may have a direct effect on a pest by modifying the food supply and an indirect effect by favoring those organisms in the forest that tend to reduce the numbers of the pest. Success may best be had where intensive forest management can be practiced.

Choice of site and species to be planted are important considerations if serious insect damage is to be prevented. Unthrifty trees invite attack.

1/ "Fifty Years of Forestry in the U.S.A." Published by Society of American Foresters.

Tolerance should be given consideration in management practices. In general, the planting or encouragement of large blocks of a single species should be avoided.

BIOLOGICAL CONTROL. "Balance in nature." If we were to represent the moods of nature by a line graph, the line would be relatively level provided that it represented eons of time. But, in our economic way of life we do not think in terms of eons. At best, we may think of a period covering 50 to 100 years if we are being farsighted. Therefore, only that part of the graph representing that period of time would be of interest to us. It immediately becomes magnified and it is anything but static. There are sharp fluctuations above and below the norm. Hence, it would be correct to say, "A balance is continually being sought in nature." The "balance" must be pictured as oscillating rather than being static.

"There are two distinct approaches to the use of biotic factors for indirect control: (1) the introduction of those organisms into areas where they do not occur and (2) the encouragement of those already present. The introduction of parasites and predators into new environments has usually been been directed against introduced pests, because these pests are, as a rule, without natural enemies in their new environment. Environmental manipulation, designed to improve conditions for native parasites and predators, applies equally well to both foreign and native pests. Although the introduction of new agencies of control has received most attention, forest entomologists have by no means neglected the possibilities of encouraging the good work of resident organisms." 2/

There are certain characteristics that are desirable in parasitic insects. Some of the more important desirable qualities are: (1) have a high rate of reproduction, (2) be synchronized with life cycle of host, (3) live in the range where host is most destructive, (4) be able to feed on other insect species, (5) be able to find and parasitize a large number of the host, (6) be a primary parasite at all times, (7) be able to compete successfully with other parasites but not supplant a more effective parasite.

Although there have been many failures and sometimes only partial success, at least 30 major insect pests have been controlled in one or more countries through the use of parasites and predators.

"The most consistent results in the biological control of insect pests have been obtained in Hawaii - the mild climate there interposes no obstacles to the development of parasites at any season. The absence of a cold winter eliminates the long hibernation period, and there is no need for an alternate host to bridge this season. Those factors have been responsible for the ineffectiveness of many promising species in the continental United States. Also, Hawaii has no prolonged dry periods of high temperatures, which handicap the natural enemies by requiring a period of inactivity in summer." 3/

2/ Forest Entomology by S. A. Graham, McGraw-Hill Book Co., Inc.

3/ U.S.D.A., Insects, The Yearbook of Agriculture, 1952.

It has also been shown that parasites sustained an epidemic of the forest tent caterpillar in Minnesota by destroying enough host insects so that the remainder had a sufficient food supply. Without a partial loss in its numbers the epidemic would have collapsed due to competition for food and subsequent starvation and disease.

Predators and parasites can and have been used successfully as a direct means of control through mass rearing and mass release, usually in citrus groves and orchards. At the present time it is not considered feasible to conduct such control over large forested areas unless some major handicaps are overcome.

VIRUSES. There has been an increased interest in viruses as they appear to be very promising and hold particular appeal since they can be used as a direct means of control and affect only a particular insect species. Their potential has not been fully investigated but there have been instances where viruses have played an important part in suppressing an epidemic. Whether some have been solely responsible in some of the cases has not been determined as the health of the host appeared to have an important bearing.

Their use precludes that the virus can be isolated efficiently and cheaply and in sufficient quantity to disseminate over large areas; that the virus will reproduce itself rapidly and that it will possess sufficient virulence over a period to kill pests that are in a good state of health. A virus of the European pine sawfly (Neodiprion sertifer) has been used successfully.

FUNGI. Conditions for the growth of fungi are generally very exacting. Sometimes insect outbreaks are suddenly brought under control by fungi. However they have never been used successfully by man as a means of controlling a forest insect since they are an active agent only under relatively warm-moist conditions. Insect outbreaks occur most frequently during periods of dry weather.

BACTERIA. Probably the most outstanding success of control through bacteria is the case of milky disease of Japanese beetle larvae. The disease is spore producing and the spores remain viable in the soil for several years. A bacterial disease of gypsy moth was found but is of little practical value in the field since it is a disease of only dense populations of the insect.

CHEMICAL CONTROL - a direct method. It wasn't until after World War II that it was deemed economically feasible to spray large acreages of forest land from the air. It may be said that aerial spraying came at a transitional period in forestry and rapid technological advances in industry.

One of the most widely used and tested insecticides was DDT. Due to exorbitant claims by advertisers and a public seeking a cure-all, DDT was used extravagantly and indiscriminately by some spray operators and the public in general for flies, mosquitos and other pests. Used with such thoughtless abandon, DDT not only became ineffectual in controlling some pests, but it often created serious problems where none existed before. Fortunately caution was exercised in controlling forest pests and excellent results have been obtained. However, these cures can be regarded only as temporary since the conditions which gave rise to the outbreaks still exist. The use of insecticides must be considered as an emergency measure and used to protect the timber until it is

harvested or until there is a change in the composition or density of the stand providing it is economically justifiable to do so. The latter case is represented by control of the Saratoga spittlebug wherein one spraying may suffice until the stand has closed and crowded out the alternate nymphal hosts.

Where native forest pests are involved with epidemics which fluctuate over the years, and where eradication is impossible, expenditure of control funds should be limited to the following situations:

1. Where insect damage threatens to cause abnormal forest tree damage.

2. Where control measures of such insects are known to be effective.

3. Where such control measures will not give rise to a secondary epidemic as a direct result of employing the control measures.

4. Where the cost of control can be justified by the timber, or other forest values to be protected.

5. Where the size of the project is not beyond the physical limitations of man power, time and money needed to treat effectively an entire entomological control unit.

To conduct control work intelligently, the general nature of epidemics should be known. Epidemics arise when ecological conditions are favorable for such a rise. What these ecological conditions are is not always understood since they vary with insect species. The ecological condition is confined to an area as a result of type, site, vigor, etc., therefore, their (the insects') spread into adjacent areas is light; in some cases up to 30 miles or more -- but, for the most part, they build up vertically and spread horizontally through weight of tremendous populations. However, the pattern of the buildup and spread in population will vary with the individual insect species.

The cost of control must be justified on the basis of suppressing or preventing losses on the area treated and the susceptible areas immediately contiguous thereto.

The object of control is usually not complete eradication. The object of effective control is to change the status of the pest from an epidemic level to an endemic level. Effective control is obtained when this objective is accomplished. However, conditions often exist in the forest which make it impossible to obtain the desired kill. In some cases the control operation may still be executed if cognizance is taken of the parasites as they exist in the field. Control is feasible if the following conditions are met: (1) Parasites of the pest are fairly abundant and efficient and in such stage of development as to be protected from the control operation and (2) a sufficient number of pests are destroyed by the direct means that the number escaping both the direct means and the parasites will represent a very small fraction of the total population.

It should also be pointed out that essentially this same principle could act to the detriment of the forest and probably result in high mortality to the trees to be protected. An added complexity is present in this case. Let us look at the following hypothetical case and assume the following conditions at time of spraying:

1. A forest pest is present causing abnormal damage.

2. A contact-stomach poison is used in an attempt to control the pest.

3. Also present and doing a nominal amount of damage is another forest pest which is resistant to the insecticide; this pest is normally controlled largely by winter weather conditions and a predator.

4. Quite a large number of the predator population is parasitized but could, in combination with the weather, overcome the second forest pest.

5. The parasites are in a stage of development where the spray will not affect them directly; the predator is in various stages of development.

6. The following winter is mild.

It is conceivable that the pest of primary importance could be controlled but in so doing, another and probably more serious pest has been advanced because: (a) it is not affected by the insecticide, (b) some of its enemies were killed by the insecticide, (c) most of the remainder of its enemies were killed by parasites and, (d) weather conditions favored its increase.

ATTITUDE OF THE TECHNICIANS. In the past there has been a distinct lack of cooperation between foresters and entomologists. It was felt that this was due largely to a lack of understanding of each other's fields. It was also felt that a forest entomologist would be better qualified if he were basically a forester; in the Wisconsin Conservation Department a forest entomologist must have a degree in forestry. In addition, all personnel connected with forestry in the department are contributing to the program and there are no restrictions by division lines. To more fully utilize the man power, administrative lines are crossed wherever it is felt the program can be augmented.

ATTITUDE OF THE PUBLIC. The public attitude has been, until recently, one of apathy and sometimes perverseness. There are signs of a change in this attitude even though it is reflected in only a relatively small number of people. It can be attributed to educational programs, subsidies, improved economic conditions, services of department personnel, etc. Interest in insects and disease has been largely in the spectacular rather than the destructive.

NEEDED IMPROVEMENT

The information given is necessarily incomplete as space does not permit detailed coverage of the subject. Much has been written and there is much work that must be done. There is not always agreement on a subject so broad and complex and often controversy exists; where such difference of opinion exists, sound arguments, in many cases, can be presented by both sides.

It is not intended to imply that we have a strong, fully developed program; actually, the surface has hardly been scratched. A good basic foundation has been laid and advancement is being made in the right direction. To further develop the program, the following improvements should be made:

Survey and Control:

1. Indoctrinate more cooperators as observers.

2. Place a forest entomologist in each area when such areas are established.

3. Change or modify existing legislation or enact new legislation to augment the program; such legislation should be workable and enforced.

4. Continue educational programs in training schools with emphasis on forest management.

5. Better regulation of planting site selection in relation to species.

6. Place more emphasis on pathology and incorporate it more closely into the program.

7. Emphasize and improve management practices based on the findings of research.

Cooperative Research: In cooperation with the University of Wisconsin

1. Establish silvicultural control units for research purposes where forest pests are known to exist.

2. Study the effects of unwarranted spraying, grazing, "clean" forestry, weather, etc. on insect populations.

3. Develop criteria of abundance for the different insect species.

4. Evaluate under field conditions the effect of some of the newer insecticides.

RESEARCH:

1. Conduct research in the control of the pine tortoise scale.

2. Continue field research in the white grub, jack pine budworm, and Saratoga spittlebug.

3. Continue and correlate research in pathology and genetics.

SUMMARY AND CONCLUSION

The program of survey and control should continue along the basic plan as established in 1949, as this appears to be most practical at this time.

The purpose is primarily the survey and control of forest pests. Pests of shade and ornamental trees, finished forest products, shrubs, etc. are the responsibility of the State Department of Agriculture; the Agriculture Department is also responsible for inspections, quarantines, licenses, etc.

Control through silvicultural practice is being given more and more weight. It is deemed to be the most practical approach and will effect the best control for the greatest length of time at the least cost; it is a preventive means rather than curative. The control must be suited for the prevailing conditions. When forestry is given recognition commensurate with its economic importance, much more forest land will be under intensive management. Therefore, the silvicultural method should be most widely used in the long run.

Controls cannot be exercised until many factors are considered. Control can be best and most reliably had when the factors of control can be manipulated effectively and cheaply. Modern management practices must take into consideration the importance of fire, grazing, insects, disease, soil, site, genetics, etc. and consider all with homogeneity rather than each as a separate function in itself.

New legislation may be advisable to augment the program. Research activities and the problems concerning the forester in the field should be integrated.

While emphasis is placed on forest management since this appears to be the most logical approach under Wisconsin conditions, such emphasis should not be made to the exclusion of other methods of prevention or control. Excellent results can be had with insecticides provided they are used with caution and discrimination. Their use can be incorporated in management plans in explicit situations. Biological control agents may be moved about when it is advantageous to do so. Introductions may be made after proper evaluations are made. With the approval of the St. Lawrence Seaway project, statutory regulations may need to be reevaluated. Quite a number of Wisconsin problems may require different methods or a combination of all available measures at different times and places and conditions.

Important Dates - 1949 through 1953

1949 - Insect control program inaugurated in Wisconsin covering the phases of survey and control.

1950 - Similar programs started in Michigan and Minnesota.

1951 - Tri-state meeting of Michigan, Minnesota and Wisconsin held at Madison, Wisconsin on April 24 to discuss mutual insect problems and survey methods and the feasibility of a coordinated system of reporting for the Lake States area.

Meeting with industry on the forest insect problem held at Eagle River on October 21 and 22, sponsored by the Wisconsin Conservation Department.

1952 - Meeting at St. Paul, Minnesota on February 7, to discuss the larch sawfly problem, sponsored by the Office of the State Entomologist.

Second annual conference on forest insect surveys in the Lake States held in Milwaukee on February 14. Purpose was twofold (1) to review developments in the organization and operation of forest insect surveys and programs of state and federal agencies in the tri-state area, and (2) to discuss reconnaissance and appraisal surveys and procedures for some specific insects.

1953 - Formation of the Central International Forest Insect and Disease Work Conference at St. Paul, Minnesota on January 6 and 7. Purpose: To make possible the interchange of forest insect and disease survey, research, and control information between entomologists and pathologists of the United States and Canada, whose problems were similar but who did not at the time possess facilities or machinery for prompt review of work in progress, or of accomplishments. Representation:

USA:	Michigan	CANADA:	Manitoba
	Minnesota		Ontario
	North Dakota		Saskatchewan
	South Dakota		
	Wisconsin		

Third Annual Forest Insect Survey Conference held in Milwaukee on February 18; Illinois represented for the first time. First combined report of forest insect conditions for the tri-state area prepared by the Forest Insect Laboratory, B.E. & P.Q., U.S.D.A., Milwaukee, Wisconsin.

Training school for detection personnel, Wisconsin Conservation Department, held at Eagle River March 23-27; forest management and insect survey and control were stressed.

Second Central International Forest Insect and Disease Conference held at Sault Ste. Marie, Canada, October 5-7.

SURVEY AND CONTROL ORGANIZATION

The responsibility for the forest pest survey and control activity rests in the Cooperative Forestry Division. A forest entomologist and an assistant are stationed in the central part of the state at Wisconsin Rapids. This headquarters was selected because of its location within the state and the availability of office and storage space.

Prior to 1953, only the personnel of this division were charged with the task of conducting specific insect surveys within their districts and reporting conditions to the center at Wisconsin Rapids. While excellent reports were received, it was felt that the coverage was not adequate. To increase the range and scope of activities, the assistance of forest protection and forests and parks personnel was added. In addition, the names of 120 representatives of county organizations and private industry were also added as supplemental observers. The number of observers in 1953 totaled 179, and of this number, 59 were department personnel.

Selection of departmental observers was based on aptitude, geographical location and intimate contact with the forest. Observers were evenly divided in respect to location and placed on two reporting schedules which were staggered. Thus reports were received at the central office weekly. A map showing the location of observers will be found on the next page. All department observers received a copy of "Insect Enemies of Eastern Forests" by Craighead, informational leaflets, reporting forms, numbered canisters for mailing specimens for identification or confirmation, and other material incidental to observing and reporting. Promptness and accuracy in reporting and practicability in applying the principles learned were stressed.

Personnel at the Wisconsin Rapids center compile the weekly and annual reports, furnish information on current conditions and information on specific insect pests to all observers, relay reports and information to the State Entomologist, the Lake States Forest Experiment Station, and the University of Wisconsin, investigate outbreaks and recommend specific control measures to be taken, provide on-the-job training of observers and furnish technical supervision of the program.

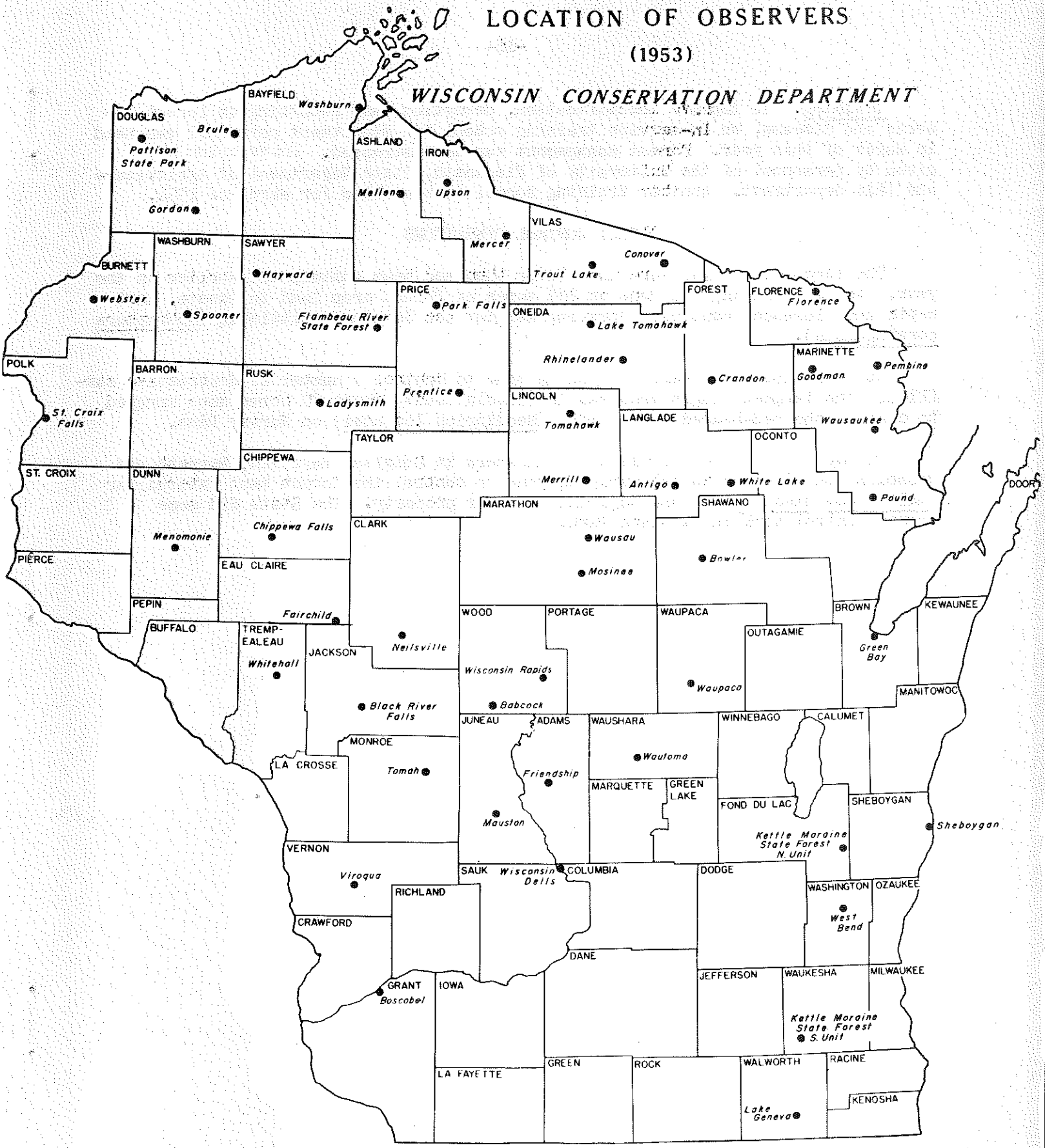
It is planned that at least two and preferably three additional forest entomologists will be added to the staff in 1954.

OBSERVATION REPORTS. During the period of May through September, a total in excess of 1300 reports was received from observers. Of these, 926 were positive on specific insects. The remainder were either negative or were discarded for lack of sufficient information.

Over 500 canisters containing specimens for determination, analysis, or recommended action were received from department personnel. In addition, many requests from persons outside of the department were received and processed.

Information on the more important problems was exchanged with the Lake States Forest Experiment Station, the adjoining states of Michigan, Minnesota and Illinois, and with Canada.

FOREST PEST SURVEY AND CONTROL



Training. To improve identification, detection, and reporting on forest insects and disease, an in-service training school for department personnel was held in March of this year. Forest management was also stressed. Instruction was given by personnel of the University of Wisconsin, State Department of Agriculture and this department. Another training school is scheduled for March of 1954.

DIRECT CONTROL OPERATIONS

The acreages sprayed were much lower than had been anticipated earlier in the year. Aerial spraying was done on 265 acres of forest crop land in Oconto, Marinette and Florence Counties. Spraying was for the Saratoga spittlebug (Aphrophora saratogensis).

At least 150 acres were sprayed by hand to control a number of destructive sawflies. The largest single area was in Lincoln County where 20 acres were sprayed to control the red-headed pine sawfly (Neodiprion lecontei) on Norway Pine.

In May and early June, private landowners in Douglas, Bayfield, Burnett and Washburn Counties had aerial spraying done to control the forest tent caterpillar (Malacosoma disstria) on and adjacent to their property. The State did some ground control work in Pattison Park.

LIST OF INSECTS AND DISEASES REPORTED

It is very difficult to describe insect abundance so that all concerned with the survey will have the same interpretation. Actual numbers, in most cases, mean very little and can often give a false impression unless other factors as site, host health, class, degree and effectiveness of inhibiting factors, etc. are also known. Therefore, the criterion of abundance used is purely relative and very general. Specific information as to location of the more important infestations of certain species may be had by writing to this department or referring to the maps on pages 23 to 30.

Criterion of abundance:

absent = no pests found on host trees.
scarce (light) = a few individuals present; no perceptible damage.
moderately abundant (medium) = damage general throughout area of infestation and possibly some form of decadence evident; center of infestation may show severe damage.
very abundant (heavy) = damage severe throughout area of infestation; some trees may be dead and others in a dying condition or insects may be doing maximum amount of damage of which they are capable of doing.
* Indicates a critical forest pest.

As compared with 1952:
I = increase
D = decrease
N = no change noted

IMPORTANT PESTS OCCURRING IN 1953

Winter Injury - Due to the exceedingly dry fall severe damage was sustained in some stands of white pine in the Wisconsin River Valley. Although the mortality was heavy in several stands, the damage wasn't nearly as great as was anticipated and must be termed light in general.

1. *Pine Bark Beetles (Pityogenes hopkinsi and Ips pini) (I) attacked drouth injured white pine in large numbers. Where there was danger of populations spilling over to attack healthy trees, sanitation measures were undertaken to prevent such an occurrence.

2. *Forest Tent Caterpillar (Malacosoma disstria) (I) - The infestation followed the pattern indicated by the 1952-53 egg survey plus an area from Minong to about seven miles east of Hayward which had not been covered by the egg survey. Centers of infestation were also found in Chippewa, Rusk, Forest and Marinette Counties.

3. *Red-headed Pine Sawfly (Neodiprion lecontei) (I) - Heavier infestations could be found over most of the state. Mortality was highest in plantations of small jack pine. Counties reporting the pest very abundant were Sauk, Sawyer, Juneau, Portage and Eau Claire. In other areas it varied from absent to moderately abundant.

4. *Jack Pine Sawfly (Neodiprion americanum banksianae) (I) - This pest was very scarce for a number of years. This year it was found to be abundant locally in Vilas County. It was reported scarce in Oneida, Douglas, Washburn and Burnett Counties.

5. *Larch Sawfly (Pristiphora erichsonii) (I) - Reported from most of the range of its host in the state except the northeast.

6. *Swaine's Jack Pine Sawfly (Neodiprion swainei) (I) - Heavy infestations were reported in Sauk, Iowa and Juneau Counties. It has never been reported north of Juneau County or east of Sauk County.

7. Red Pine Sawfly (Neodiprion nanulus) (I) - Light to moderate infestations were reported locally in several counties. Incidence was highest in Waushara and Wood Counties. Waupaca, Washburn, Marathon, Burnett and Douglas reported light infestations.

8. *Introduced Pine Sawfly (Diprion similis) (D) - Although there was a slight increase in the range of this pest, there was an appreciable drop in population in practically all areas of infestation. This drop is attributed to several parasites. The infestation was confined to 17 western counties. Principal host is white pine.

9. White Pine Sawfly (Neodiprion pinetum) (I) - Light infestations were reported in Fond du Lac, Marathon and Dodge Counties. The increase is of little consequence.

10. White Pine Weevil (Pissodes strobi) (D) - High populations were found in many counties in open grown white pine and Norway spruce and poorly stocked stands of jack pine.

11. *Saratoga Spittlebug (Aphrophora saratogensis) (D) - While several new areas of infestation were reported in Wood, Jackson and Eau Claire Counties, there was a decrease in the over-all population due largely to direct control measures and closing of the more susceptible stands.

12. *Pine Tortoise Scale (Toumeyella numismaticum) (I) - Heavy populations throughout the state were quickly brought under control by ladybird beetles except on some of the best plantations of jack pine in Marinette and Florence Counties. The ladybird beetles in these areas were rendered ineffective by a parasite, Scymnophagus townsendi. This couple with two consecutive mild winters has developed into a serious problem.

13. *Jack Pine Budworm (Choristoneura Pinus) (I) - Infestations in general have been light. The greatest potential danger at this time appears to be in Douglas and Washburn Counties.

14. *Pine Tussock Moth (Olene plagiata) (I) - The population level of this pest remained low in 1953.

15. Birch Leaf Skeletonizer (Bucculatrix canadensisella) (I) - Defoliation by this insect became apparent over the entire state late in the summer.

16. Pine Bark Louse (Pineus strobi) (N) - This pest remained at a high level in all areas but damage was noticeable on seedling stock only except in some isolated cases where trees up to 12 feet were killed.

17. *Larch Casebearer (Coleophora laricella) (D) - This pest is present over the range of its host. There was a very noticeable decrease in the northeast quarter of the state and a lesser decrease in other parts of the state. Very few parasites were found; finches were numerous.

18. Jack Pine Eucosma (Eucosma sonomana) (N) - This insect continues abundant over the state in young, pure, even-aged jack pine stands. The severity of the infestations has been observed to have decreased with age and closing of the stands.

IMPORTANT RECENT INSECT INTRODUCTIONS

19. *European Pine Shoot Moth (Rhyacionia buoliana) (I) - This pest of Norway pine continues to spread northward and has been found as far north as Manitowoc. Infestations were heavy in Milwaukee, Waukesha and Sheboygan Counties. Infestations in Milwaukee are sustained largely by mugho pine.

20. *Smaller European Elm Bark Beetle (Scolytus multistriatus) An isolated case was found in 1952 in Wausatosa, a suburb of Milwaukee. This pest is associated with Dutch Elm Disease which follows shortly after the bark beetle vector. This is the only case reported to date in Wisconsin.

INSECTS OF A LESSER IMPORTANCE IN 1953

White Grubs (Phyllophaga spp.) - Light to moderate infestations in new plantations were reported. Some damage occurred in the Green Bay area and Marathon County.

Red Turpentine Beetle (Dendroctonus valens) - Attacking pine in cases of weakened and offsite trees. Light infestations were reported in the central area.

Yellow-headed Spruce Sawfly (Pikonema alaskensis) - This insect is not a serious pest of the forests in Wisconsin at present, but appears to be affecting a greater number of trees than in 1953.

Popple Leaf Tier (Anacampsis innocuella) - The defoliation was reported medium in the north central area. The damage was not of a serious nature to the popple.

Walking Sticks (Diapheromera femorata) - Heavy to moderate infestations were reported locally in several counties. Damage was concentrated in the northeast and was spotty elsewhere. There appears to be a definite increase in the number of infestations over 1951. (This insect has a 2-year cycle, therefore comparisons cannot be made with the previous year but two years previous.)

Pine Spittlebug (Aphrophora parallela) - The insect was abundant on all species of pine. Damage was not appreciable except on Scotch pine.

Pitch Twig Moth (Petrova albicapitana) - Light to moderate infestations occurred generally in jack pine plantations over the entire state. Control measures are ineffective and difficult due to the nature of the insect.

Pitch Mass Borer (Parharmonia pini) - Scattered trees infected in Wood and Trempealeau Counties.

Root Collar Weevil (Hylobius radicis) - There was a sharp decrease in the number of reports received.

Pine Webworm (Tetralopha robustella) - This insect reversed from heavy in 1952 to very light populations in 1953.

Eastern Tent Caterpillar (Malacosoma americana) - Moderate populations occurred generally throughout the state. Some damage on shade and orchard trees.

Zimmerman Pine Moth (Dioryctria zimmermani) - Light populations were reported on Norway pine. Damage was limited to a few branches on plantation trees from 15 to 20 years old.

Balsam Fir Sawfly (Neodiprion abietis) - Some specimens found on spruce in Marathon County.

OTHER INSECTS REPORTED IN 1953

Hemlock Leaf Miner (Recurvaria apicitripunctella)

European Elm Scale (Gossyparia spuria)

Elm Woolly Aphid (Eriosoma americanum)

Pine Needle Scale (Phenacaspis pinifoliae)

Aspen Leaf Beetle (Chrysomela scripta)

Spruce Needle Miner (Recurvaria piceaella)

Ash Sawfly (Tomostethus multicinctus)

Larch Woolly Aphid (Chermes strobilobius)

Pales Weevil (Hylobius pales)

Cottony Maple Scale (Pulvinaria vitis)

Spring Cankerworm (Paleacrita vernata)

Bronze Birch Borer (Agrilus anxius)

Dusky Birch Sawfly (Croesus latitarsus)

Woolly Alder Aphid (Prociphilus tessellatus)

Oak Webworm (Archips fervidana)

Fall Webworm (Hyphantria cunea)

Oak Twig Pruner (Hypermallus villosus)

Elm Sawfly (Cimbex americana)

Locust Borer (Megacyllene robiniae)

Red-humped Caterpillar (Schizura concinna)

Yellow-necked Caterpillar (Datana ministra)

Pine False Webworm (Acantholyda erythrocephala)

Spruce Gall Adelges (Chermes abietis)

Pine Sawyer (Monochamus sp.)

_____ (Pissodes approximatus)

DISEASES AND DAMAGE REPORTED IN 1953

*Blister Rust (*Cronartium ribicola*)

Oak Gall Rust (*Cronartium cerebrum*)

Armillaria Root Rot (*Armillaria mellea*)

Sweetfern Blister Rust (*Cronartium comptoniae*)

Pine Needle Rust (*Coleosporium solidaginis*)

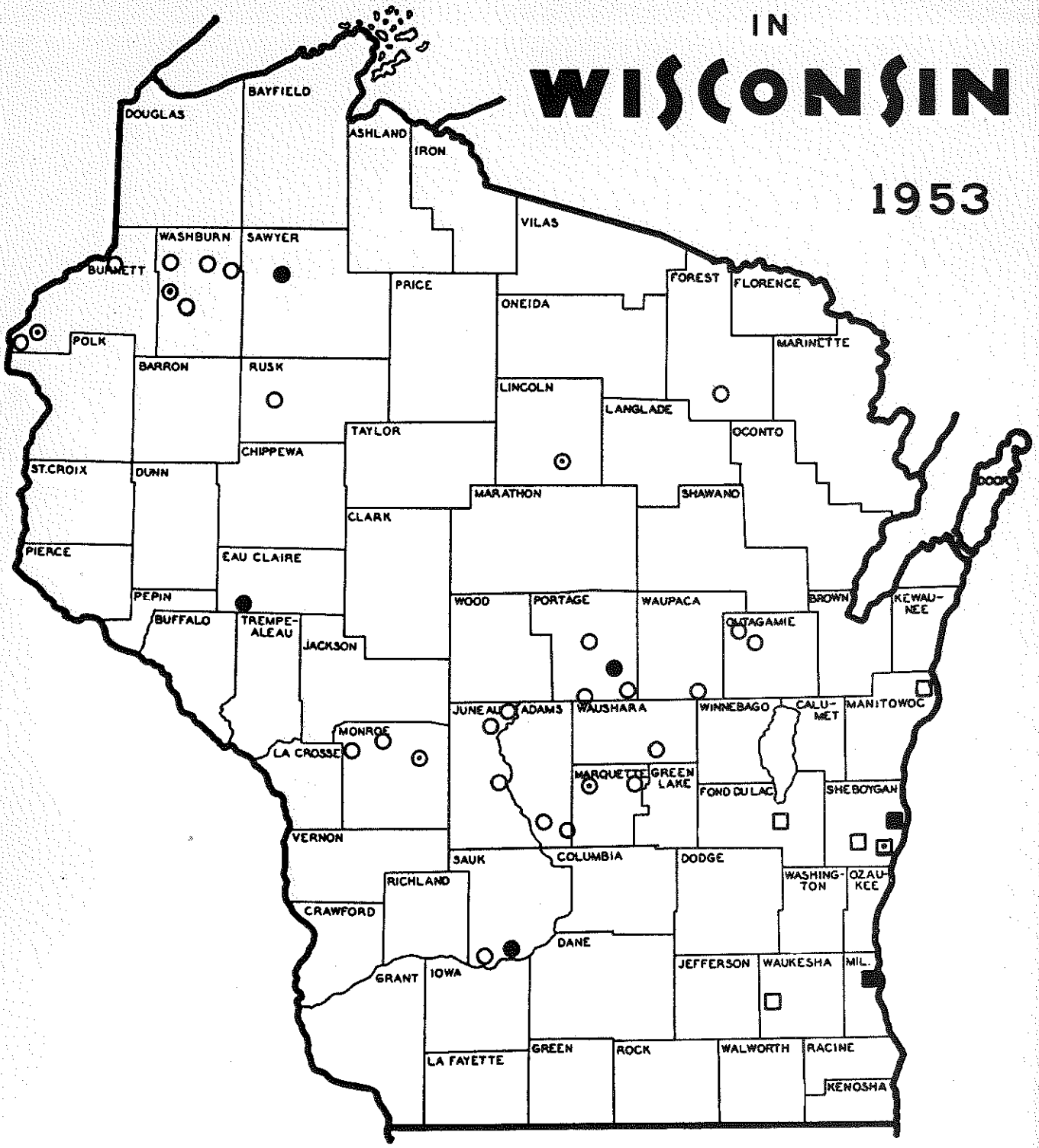
Needle Cast (*Hypodermella ampla*)

Oak Wilt (*Chalara quercina*)

Squirrel Damage

Information pertaining to forest insect conditions in Wisconsin was developed in cooperation with the USDA, Forest Service, and the Lake States Forest Experiment Station.

FOREST INSECT CONDITIONS IN WISCONSIN 1953



AREAS OF THE IMPORTANT INFESTATIONS OF 1953

EUROPEAN PINE SHOOT MOTH

- □ *LIGHT INFESTATION*
- ⊡ *MEDIUM INFESTATION*
- ■ *HEAVY INFESTATION*

RED-HEADED PINE SAWFLY

- ○ *LIGHT INFESTATION*
- ⊙ *MEDIUM INFESTATION*
- ● *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

AREAS OF THE IMPORTANT INFESTATIONS OF 1953

JACK PINE SAWFLY

- ○ *LIGHT INFESTATION*
- ◎ *MEDIUM INFESTATION*
- ● *HEAVY INFESTATION*

SWAINE'S SAWFLY

- □ *LIGHT INFESTATION*
- ⊡ *MEDIUM INFESTATION*
- ■ *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

AREAS OF THE IMPORTANT INFESTATIONS OF 1953

JACK PINE BUDWORM	PINE TORTOISE SCALE
□ *LIGHT INFESTATION*	○ *LIGHT INFESTATION*
⊡ *MEDIUM INFESTATION*	⊙ *MEDIUM INFESTATION*
■ *HEAVY INFESTATION*	● *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

AREAS OF THE IMPORTANT INFESTATIONS OF 1953

WHITE PINE SAWFLY

- □ *LIGHT INFESTATION*
- ⊡ *MEDIUM INFESTATION*
- ■ *HEAVY INFESTATION*

RED PINE SAWFLY

- ○ *LIGHT INFESTATION*
- ⊙ *MEDIUM INFESTATION*
- ● *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

AREAS OF THE IMPORTANT INFESTATIONS OF 1953

SARATOGA SPITTLE BUG

- □ *LIGHT INFESTATION*
- ⊡ *MEDIUM INFESTATION*
- ■ *HEAVY INFESTATION*

INTRODUCED PINE SAWFLY

- ○ *LIGHT INFESTATION*
- ⊙ *MEDIUM INFESTATION*
- ● *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

AREAS OF THE IMPORTANT INFESTATIONS OF 1953

EUROPEAN ELM BARK BEETLE

- □ *LIGHT INFESTATION*
- ⊡ *MEDIUM INFESTATION*
- ■ *HEAVY INFESTATION*

PINE TUSSOCK MOTH

- ○ *LIGHT INFESTATION*
- ⊙ *MEDIUM INFESTATION*
- ● *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

AREAS OF THE IMPORTANT INFESTATIONS OF 1953

LARCH CASEBEARER

- ○ *LIGHT INFESTATION*
- ⊙ *MEDIUM INFESTATION*
- ● *HEAVY INFESTATION*

FOREST INSECT CONDITIONS IN WISCONSIN 1953

FOREST TENT CATERPILLAR DEFOLIATION

DEGREES OF ABUNDANCE

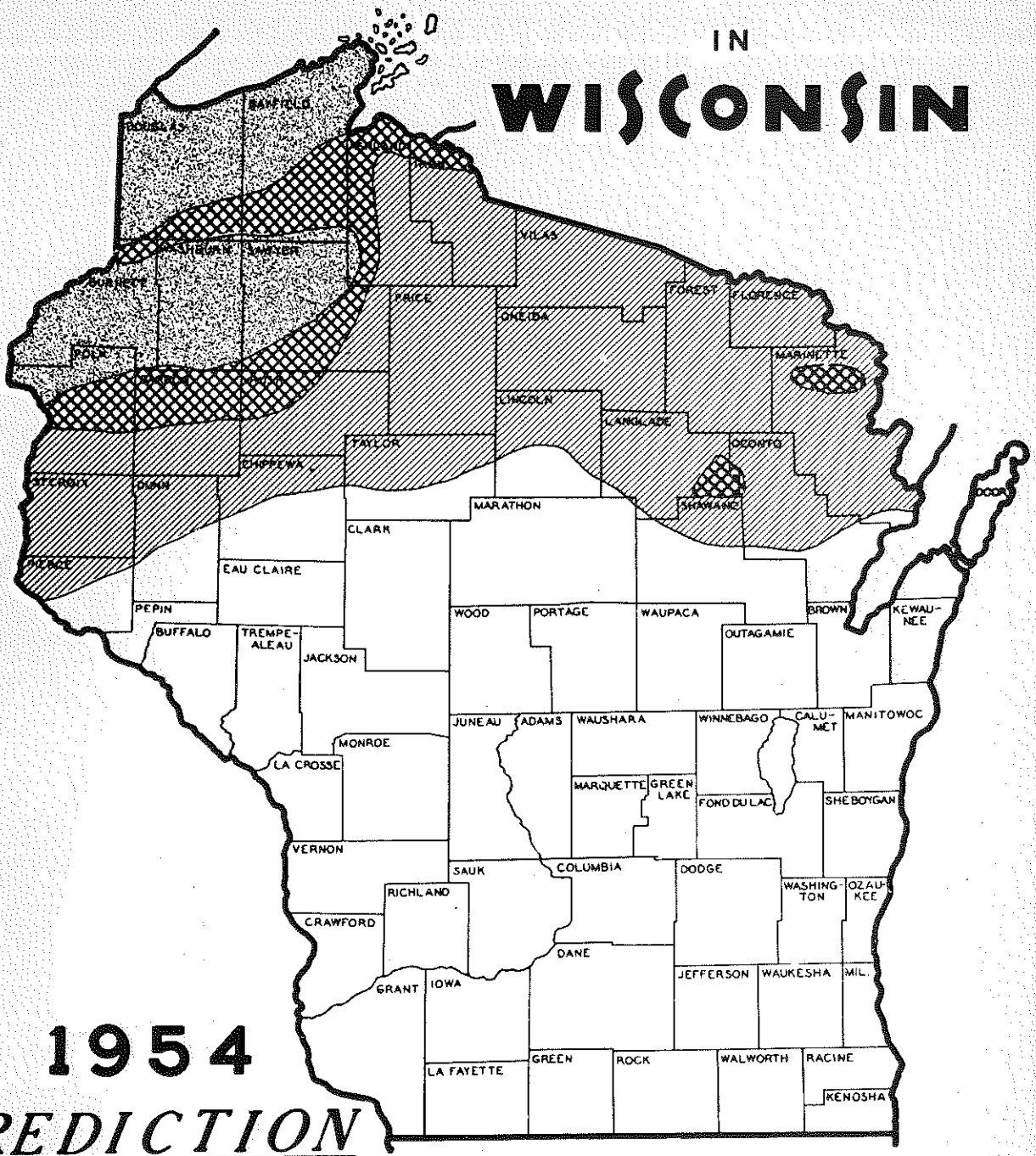
HEAVY

MEDIUM

LIGHT

THIS MAP DEPICTING THE DEGREES OF DEFOLIATION WAS PREPARED FROM FIELD SURVEYS CONDUCTED BY FIELD PERSONNEL OF THE DEPARTMENT

FOREST INSECT CONDITIONS IN WISCONSIN



1954 *PREDICTION*

FOREST TENT CATERPILLAR INFESTATION

DEGREES OF ABUNDANCE

- HEAVY
- MEDIUM
- LIGHT

ANTICIPATED AREAS AND DEGREES OF INFESTATIONS FOR 1954 BASED ON A WINTER EGG BAND SURVEY